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CONSTRUCTION AND EQUIPMENT

No. 74

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CONTENTS

CONSTRUCTION

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GOSSTROY OFFICIAL ON CAPITAL CONSTRUCTION IMPROVEMENTS

Moscow EKONOMIKA STROITEL'STVA in Russian No 6, Jun 82 (signed to press 19 May 82) pp 3-10

[Article by A. A. Borovoy, First Deputy Chairman of the USSR Gosstroy: "Scientific-Technical Progress in Capital Construction" (under the heading: "Economic Effectiveness of Construction Production")]

[Text] The 26th CPSU Congress determined that the basic task of capital construction is to increase the country's production potential on a new technical basis, to install housing and municipal-services, personal-services and sociocultural facilities. Comrade L. I. Brezhnev pointed out the important role of capital construction as a decisive sector of the national economy in a speech at the November (1981) CPSU Central Committee Plenum.

The current five-year plan outlines an ambitious construction program. Nuclear power plants with a total capacity of 24-25 million kilowatts, large thermal electric power plants using Ekibastuz and Kansko-Achinsk coals and Western Siberian gas, new power units at the Kolymskaya, Shamkhorskaya, Kuprsayskaya and Tash-Kumyrskaya hydroelectric power plants, 1,500- and 1,150-kV dc and ac, respectively, power transmission lines, high-capacity gas pipelines and large new production capacities in ferrous and nonferrous metallurgy, machinebuilding, chemical and petrochemical, fuel, light, food and other branches of industry will be put into operation through its implementation. Continuous train traffic will begin on the Baykal-Amur Mainline.

During the 11th Five-Year Plan, a total of 530 million square meters of housing and a large number of schools, kindergartens, hospitals, polyclinics, movie theaters, stores and personal-services facilities will be built in cities and rural areas.

Given the broad scope of construction in the country, continued improvement in the effectiveness of capital construction on the basis of scientific-technical progress acquires decisive importance in ensuring the necessary rates of development of the national economy, which has enormous fixed production assets available to it.

Scientific-technical progress in capital construction largely predetermines the rates of this progress in the national economy. In turn, the successful development of capital construction is possible only if the technical level of all social production is constantly raised.

It should be emphasized in speaking about the role of scientific-technical progress in increasing capital construction effectiveness that science is becoming an ever-increasingly direct productive force. In this regard, it is no longer individual scientific achievements but overall results as manifested in a high scientific-technical level of construction production and projects released for operation which are moving to the fore.

Domestic science has quite a few achievements in solving the theoretical and practical problems of scientific-technical progress in capital construction. It has occupied the leading frontiers of work science in individual directions. However, this cannot and must not push into the background substantial shortcomings in the activity of scientific organizations and the agencies directing them.

Thus, the network of scientific research organizations which evolved previously does not provide an opportunity to concentrate scientific forces fully on solving the key problems of scientific-technical progress in capital construction. Not all research is being carried through to the stage at which it can be used in practice. Therefore, by no means all research results reach the state plans for utilizing new equipment.

The ties between applied research institutes and organizations conducting fundamental research in the field of construction, including institutes of the USSR and union republic academies of sciences and VUZ laboratories, are still very weak.

Construction science owes practice a great deal. Such problems as the development of materials with prescribed properties, the development of norms which take into account methods of calculating on the basis of reliability theory and statistical methods, the use of those methods in practice and the creation of a better normative base for calculating components at their maximum remain critical.

There have heretofore been no economic criteria for evaluating the effectiveness of capital investments on social and environmental-protection measures or scientifically substantiated methods for corresponding economic calculations. Solving these problems is an important work sector for economists.

All this testifies eloquently to the importance of the tasks facing science, which is called upon to be a decisive factor in increasing the effectiveness of construction production and obtaining the best results with the least expenditures of resources.

The ways of increasing the return on scientific research are determined in the CPSU Central Committee and USSR Council of Ministers decree "On Steps to Increase the Effectiveness of Scientific Research In the Areas of Construction, Architecture, Building Materials, Construction and Road Machinebuilding and Accelerating the Introduction of Scientific Achievements Into Construction Practice." In accordance with this document, the USSR Gosstroy has been entrusted with the responsibility for the development and direction of science in this area, as well as with coordinating all the scientific research in it.

Steps are being taken under USSR Gosstroy leadership to improve the existing network of scientific organizations and to put their subject-matter orientation into proper order.

The multipurpose scientific and experimental planning lead institutes, with their material-technical and experimental base, are doing research and development on each major direction of branch and applied science. They are also called upon to coordinate the activity of various scientific organizations, regardless of departmental subordination.

Unfortunately, the availability of capital to scientific research institutes working in the field of construction is currently three-fold lower per worker on establishement than for organizations subordinated to the State Committee for Science and Technology and five-fold lower than for institutes of the USSR Academy of Sciences. Moreover, the indicator of overall specific expenditures on scientific research per scientist is three- to seven-fold lower in construction and expenditures on equipment comprise only about seven percent of all allocations for this work, that is, nearly three-fold less than the national average. Energetic steps are therefore being taken to develop the material-technical and experimental base needed to bring scientific research and design work in construction to a state of readiness at which they can be embodied in a manufactured prototype.

Under the above decree, scientific-technical planning must be transferred to a target-program basis to the maximum extent possible. Experience in recent years confirms the great effectiveness of comprehensively resolving problems on the basis of a target-program method of planning which permits a close linking of the development and introduction of new equipment in terms of resources, people performing the work and work schedules.

In order to resolve the tasks facing the national economy in the 11th Five-Year Plan, we have worked out scientific-technical programs relating to various branches of the national economy. Among them are the 10 most important construction programs, including one comprehensive target program. Some 75 ministries and departments and more than 400 implementing organizations, including about 70 VUZ's, have been enlisted in carrying them out. About 29,000 scientists, including 345 doctors of sciences and 6,580 candidates of sciences, are working on implementing the programs in 185 scientific organizations concerned with construction questions. They are doing more than 250 million rubles worth of work a year.

It is characteristic of capital construction that the most effective results are often achieved not as a sum of scientific developments in construction production proper, but thanks to fundamental research and the achievements of applied science in related fields, foremost in the technology of industrial production. It is therefore understandable how important it is to create a precise system of linking scientific developments to accelerate scientific and technical progress in capital construction. A broad range of diverse problems involving fundamental improvement in the state of affairs in capital construction, increasing its effectiveness and actualizing party and governmental resolutions can be resolved more successfully as a result of combining the efforts of scientists.

Scientific-technical progress in capital construction has its own specific features. Elements of an explosive nature are inherent to it. Their appearance reveals the necessity and national-economic effectiveness of accelerating the development of individual branches of the national economy and industry, demanding the maneuvering of capital investments and material-technical resources. It is therefore appropriate, to ensure state-plan balance, to target-designate material and technical reserves for "peak loads" in the economy caused by the resolution of market tasks, including the outstripping development of individual branches, subbranches and types of production in which conditions have been created for the broad introduction of scientific-technical achievements. This is the most complex sector of economic management, since decisions on it are connected with a certain degree of risk and require scientific analysis of developing trends and the anticipation of possible changes.

In order to transform capital construction into a unified, smooth process of planning, producing and delivering equipment, components and parts, performing construction-installation work, putting projects into operation and mastering planned capacities, it is very important to improve the mechanism for managing scientific and technical progress.

Practice indicates the necessity of using generalizing indicators of technical level and economic effectiveness characterizing the results of using scientific-technical achievements revealed in improved labor productivity, increased profit and the successful resolution of social tasks when planning the development of science and engineering in construction. Science and engineering development plans must not, as often occurs, be a collection of individual measures not linked to assignments on labor productivity growth, lowering the net cost of construction-installation work and saving materials, that is, they must not be a kind of adjunct to assignments on basic production activity.

That is why it is so urgently necessary that we accelerate the changeover of the branch ministries to the new system of planning, financing and economically stimulating the development, mastering and introduction of new equipment which anticipates an interconnected resolution of the entire range of these questions, including ruble control of plan fulfillment on the basis of job-authorization orders and self-financing of branch technical development, including construction, orienting this process towards actual economic impact.

In order to reduce job duration throughout the "science - planning - construction" cycle and, consequently, to obtain a maximum return on new scientific and technical developments, it is appropriate to change over to combined target-program work methods throughout this chain. The branch client ministries should obviously be entrusted with coordinating the activity of participants in such comprehensive target programs.

The necessity for such an approach is dictated by the fact that, as domestic and foreign experience bear out, improving technology and the equipment being used in practically all branches of industry has a decisive influence on scientific-technical progress and raising the technical level of construction. Thus, the distribution of technological equipment in a number of branches -- chemical, petrochemical, food and power engineering, and at open sites -- enabled us to fundamentally alter the structural and modular-layout resolutions of enterprises,

use qualitatively different methods of construction production organization and technology, sharply reduce (10- to 15-fold) work volume, labor-intensiveness and duration, and increase the labor productivity of construction workers.

Changing over to the new method of vinylchloride production under balanced conditions with open distribution of high unit-power equipment has enabled us to use ethylene, a cheaper raw material than acetylene, resulting in a four-fold reduction in specific raw material expenditures, nearly a 15-fold reduction in construction-installation work volume, and a 10-fold reduction in the labor-intensiveness of that work.

The normative documents being developed by the USSR Gosstroy, which now must contain only general mandatory requirements, permitting designers broad creative initiative, are an effective form of introducing scientific and technical achievements into production, as well as an effective means of conducting a unified technical policy in planning.

An important role in accelerating scientific and technical progress in construction belongs to planning, which serves as a connecting link between science and production. The ways of raising the scientific-technical level of planning with consideration of prospects for developing the economy, science and engineering, are set forth in the CPSU Central Committee and USSR Council of Ministers decree "On Steps to Further Improve Estimate-Planning Work." The measures outlined in this document to restructure planning and the work of planning organizations are aimed at orienting each plan being developed towards ensuring good capital investment effectiveness and maximum use of the achievements of scientific and technical progress. Also of considerable importance is the fact that the estimated cost of construction is viewed as a dynamic economic category in the decree for ensuring the reliability and stability of capital construction plans. When determining it for large projects with long construction periods, consideration must be given to the influence of changes in many price-forming factors over time, including those occurring under the impact of scientific and technical progress.

Along with the open placement of technological equipment, increasing unit capacity and modular-unit construction, one other basic planning direction which ensures the acceleration of scientific-technical progress in construction is the construction of new industrial projects primarily as part of a system of industrial centers with consolidated basic, auxiliary and service production facilities, engineering networks and utilities.

The siting of upwards of 5,000 industrial enterprises in more than 400 industrial centers with total capital investments of 60 billion rubles provides an opportunity to lower construction estimated cost by 1.5 billion rubles and to lower annual operating expenditures by 250 million rubles. The size of the sites needed is reduced by a total of 15,000 ha and the length of railroads and highways needed is reduced by 1,000 km.

Perfecting the modular-layout and structural resolutions of buildings in the broadest sense of these concepts serves scientific and technical progress in construction.

Thus, locating the entire production complex in a single 4.3 million cubic meter building when planning the Ust'-Ilimskiy Pulp Mill enabled us to reduce intershop circuits and utilities and the outside area enclosed to a minimum, to reduce the operating expenditures on ventilation and heating under these harsh climatic conditions, and to lower the estimated cost of construction by two million rubles.

Industrializing construction production by transforming it into a process close to industrial production in character remains the general direction of scientific-technical progress in construction, as well as its final goal. This will enable us to raise the labor productivity of construction workers in a planned manner, reduce labor expenditures at the construction site and transfer the bulk of them to plant conditions, improve work quality and reduce the time involved in construction work. This five-year period, the level of production building prefabrication will already be increased to 45-50 percent, to 80-95 percent for housing and civil-construction projects. Industry, and especially building materials industry, are thus faced with the task of providing construction sites with complete sets of output with a high degree of factory finish smoothly and following construction and installation schedules.

The by now well-known and tested junction [uzlovoy], flow-line, complete-unit and other effective methods of organizing the construction process which make extensive use of systems of machines and vehicles of various types, type-sizes and modifications must find large-scale application.

The effectiveness of the basic direction of scientific and technical progress in the branch -- industrialization of production -- has repeatedly been confirmed by practice. Thus, for example, the manufacture of transportable stationary buildings with installed technological equipment, utilities and systems (the complete-unit method of construction) under industrial conditions enabled us to put the first line of the Orenburg Gas Field into operation eight months ahead of schedule.

Technical progress reflected in construction end results -- in finished projects and in construction production itself -- is largely determined by the progressiveness of construction components and the effectiveness of the materials with which they are manufactured.

Typification and standardization are important means of industrializing the construction process, the production of building and installation components and elements.

The whole construction typification and standardization policy is concretely embodied in the system of component and item catalogs. The unionwide catalog approved by the USSR Gosstroy predetermines the overall ideology and direction of construction component typification and standardization, and the territorial catalogs developed from them enable us to take into account project specifics characteristic of particular construction regions, as well as the construction-industry features of the corresponding region of the country.

The top-priority task of construction industry today and in the future is to develop and master the production of special building and installation structural

elements and equipment for putting up industrial projects under special conditions such as in regions of the North and Far East, in regions with difficult access, in regions of high seismicity, in permafrost regions and also when necessary to build projects fast and with minimum labor expenditures. One example of such structural elements could be building frames made of fully factory-finished glued wooden components with prefabricated elements whose size and weight provide an opportunity to transport and assemble them effectively. Also promising are large-span pneumatic components, new types of structural components mass produced using rolled sections, effective collapsible modular-section components for the auxiliary shops of compressor and pump stations and general-service premises for use when installing gas and petroleum pipelines. Mobile stock buildings made of various lightweight components and using effective heaters must also find broad application. The development of special-duty [vakhtovaya] and expeditionary methods of construction organization is of important significance for the scattered construction of projects in unutilized regions of the northern and eastern zones.

The achievements of scientific-technical progress must be used to improve the quality of building materials and components, a substantial reserve for improving the effectiveness of capital construction.

One of the top-priority scientific tasks requiring resolution to increase construction effectiveness is to reduce materials-intensiveness. Decreasing it by just one percent provides an opportunity to lower the cost of construction-installation work by approximately 400 million rubles (compared with 1980).

In order to successfully resolve this task, fundamental advances in the material resources structure are needed. We need to actualize in practice the principle of balanced, outstripping development of related branches supplying construction with materials.

The general directions for improving the provision of construction with effective material resources and optimizing their structure are as follows. First, it means the more extensive use of polymer raw materials and items made from them, improving the structure and assortment of metal products used in construction, and increasing the proportion of economical rolled metal sections and effective brands of steel. Improved and high-strength steel currently comprises only 20-23 percent of all the section and sheet metal used in capital construction. At the same time, increasing that proportion would enable us to lower component weight by 12-50 percent. The broader application of strip I-beams would provide an opportunity to save up to four percent of the metal and approximately 20 percent of the labor used in manufacturing components. For example, the use of girderless roofs with beams made of welded curved closed sections in place of traditional components would be a more efficient concentration of metal, would reduce the number of elements being manufactured and the load on each beam, would simplify their design and accelerate their manufacture. Labor productivity in beam production would increase nearly 1.5-fold. In this regard, 15-20 percent of the metal would be saved.

Further increasing the proportion of effective types of reinforcing steel used in manufacturing prefabricated reinforced concrete, organizing the production and delivery of fully factory-finished carpentry items, glued wooden components

in particular, and also wood-fiber and splint-slab sheet, large-format construction plywood and effective heaters, and the more extensive use of aluminum components and items and components made of lightweight and cellular concretes are of important significance in improving the provision of construction with material resources. We need to ensure a transition to the large-scale manufacture of reinforced-concrete support components made of high-strength 600-800 brand and higher concretes, with the use of high-grade cements and the broader use of higher-strength reinforcing steel. Organizing the production of just two million cubic meters of such components a year would enable us to save 30 million rubles, 80,000 tons of steel and up to 100,000 cubic meters of concrete.

The use of prestressed honeycomb panels with lightweight reinforcing for roofs on housing and public buildings provides a significant reduction in steel and labor expenditures. Expanding the production of span-wide prestressed roofing panels is a promising direction of scientific-technical progress in construction. The use of prefabricated reinforced concrete in industry and the use of superplasticizers in reinforced concrete stand pipe production are highly effective. In this regard, pipe-molding time is reduced two- to three-fold, pipe grade is improved by approximately 25 percent, and in many instances it becomes possible to do without steel pipe.

The problem of further raising the level of construction mechanization must be solved. Saturating it with traditional machinery no longer ensures the needed rates of intensification of the production process or of technical and economic progress in the branch. All the efforts of construction equipment developers and manufactures must therefore be directed at developing and mastering as quickly as possible machinery with a significantly higher unit power and productivity, with a higher level of comfort and control mechanization and automation.

In order to resolve the tasks facing construction, the average power of the basic machinery must, domestic and foreign experience shows, be increased at least two- to three-fold in the very near future. The whole system of machinery, together with means of transport, must correspond as fully as possible to the technological, organizational and natural-climatic conditions of construction production, providing an opportunity to create optimum complete sets of means of mechanization and transport for all the technological processes involved in erecting or renovating buildings and structures.

One of the main ways of overcoming existing shortcomings in the development of construction and its material-technical base, as was stressed in the CPSU Central Committee and USSR Council of Ministers decree on perfecting the economic mechanism, is scientific improvement in construction organization and management. It is especially important to solve this problem given the major advances occurring in the dislocation of concentrated construction.

Experience urges that construction organization and management improvements occur basically following the territorial principle, given that the development of construction industry enterprises is properly set up. In this regard, the closest possible attention must be paid to creating mobile construction organizations which can be used to concentrate forces and means at major construction projects in peak periods and work on a broader front, as well as to creating

mobile production bases for them. Development of the network of mobile organizations will facilitate reducing construction duration.

Capital construction planning is a most important link in implementing scientific and technical achievements in industry and construction. Unfortunately, many fundamental shortcomings have still not been eliminated in this area. Steps aimed at improving it have been carried out half-heartedly.

The five-year plan is currently practically the sole source of information on prospects for developing the national economy and its branches, although an entirely inadequate one. The development of more long-range capital construction plans -- for 15 years in individual branches and the national economy as a whole -- is therefore of top-priority importance. This is especially necessary for creating a scientific-technical stockpile and for actualizing it in plans.

Plans for developing and distributing the appropriate branches must become the most important scientific document substantiating the construction program in branches of the national economy over the long term and determining the direction of scientific-technical progress. By being interlinked and balanced with the country's resources, they can become the starting point for creating each enterprise or facility and, most importantly, they will accumulate the entire technical and economic policy of intensive branch development. Only thus will we be able to seal off the scattering of capital investment, which leads to an increase in construction duration, to the involvement of more time in introducing new production technology, progressive design and planning resolutions.

Concentrating capital investments enables us not only to put up projects faster, but also provides an opportunity to create conditions for the more complete and effective use of highly productive equipment and for introducing progressive work methods.

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CONSTRUCTION MACHINERY

THRIFT IN MINISTRY OF HEAVY AND TRANSPORT MACHINEBUILDING

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 6, Jun 82 (signed to press 25 May 82) pp 24-30

[Article by Ye. Matveyev, USSR Deputy Minister of Heavy and Transport Machinebuilding: "Using Material Resources More Effectively"]

[Text] Economists estimate that the amount of raw and other materials and fuel consumed in our country almost doubles every 10 years. The Accountability Report to the 26th CPSU Congress noted that "our continued advance will depend increasingly on the skillful and effective use of all available resources -- labor, fixed assets, fuel and raw material...."[1]

Special attention is currently being paid to this work at enterprises and in organizations of heavy and transport machinebuilding. As the scale of production increases, the importance of each percent of resources savings also increases. This is borne out by the figures. A reduction of just one percent in net cost means a savings of 43 million rubles in production expenditures for the branch. And for the branch as a whole, the proportion of material expenditures in output net cost is 64 percent. Hence the top-priority importance of fighting for economy and thrift under present conditions.

Enterprises of heavy and transport machinebuilding produce machinery and equipment which ensures technical progress in ferrous and nonferrous metallurgy, coal and geological-surveying industry, petroleum and gas industry, rail transport, the maritime and river fleets. It is designed to operate for long periods (30 to 50 years), which places a special responsibility on the branch. The unit power and productiveness of the machinery and equipment must not become obsolete for many years, and the energy consumption level must be economical.

At present, the branch produces more than 3,500 different machines, units, pieces of equipment and items, 700 of which are consumer goods. Output is continuously being updated. During the 10th Five-Year Plan alone, upwards of 1,000 new and modernized machines were mastered and 275 types of obsolete equipment were withdrawn from production. The economic impact of using the new machines in the national economy was 3.5 billion rubles. As of 1 January 1982, some

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[1] "Materialy XXVI s"yezda KPSS" [Materials of the 26th CPSU Congress], Moscow, Politizdat, 1981, p 42.

35.1 percent of all branch output bore the state Badge of Quality. The attainment of these indicators was preceded by much preparatory work by plant technical services, scientific research and planning-design organizations. Normative-technical documentation for all types of machinery and output -- more than 1,500 specifications and nearly all standards -- has been reviewed over the last year and a half.

The new specifications contain refinements of indicators of durability, reliability, warranteed service life prior to major overhaul, oil and fuel use. They are obligated to include indicators on specific metals- (along with machine weight), labor- and energy-intensiveness. The practical value of the new indicators is that they reflect normative expenditures for the entire period of machinery operation at the consumer, that is, the economic effectiveness of machinery operation in the national economy.

We intend to master 700 new types of equipment, modernize more than 400 machines and units, and withdraw 296 types of obsolete designs from production in the 11th Five-Year Plan. Economists estimate that the country will obtain a savings of three billion rubles in the form of 1.8 million tons of metal, 475,000 tons of fuel and 157,000 tons of oil from the introduction of new equipment being developed by Ministry of Heavy and Transport Machinebuilding plants in the 11th Five-Year Plan. This will permit the mining of two billion cubic meters more ore using improved excavators, the shipment of 41 million tons more freight in new rail cars, the smelting of two million tons more liquid steel in new convertors and smelting furnaces, obtaining three million tons more rolled metal at facilities for continuously teeming steel, and drilling 2.5 million meters more worth of wells.

Heavy and transport machinebuilding is a major consumer of metal here. It is therefore necessary to work constantly on lowering the metals-intensiveness of the machinery being developed. The most important aspect of this work is to improve machinery and equipment design. We could give many examples of sharp reductions in metals-intensiveness. Thus, the "Elektrostal'tyazhmash" production association created a pipe arc-welding mill for manufacturing two-layer 1420-mm gas pipeline. Its productiveness is 1.8 million tons of pipe per year. The technology for manufacturing pipe is such that it enables us to save up to 500,000 tons of rolled sheet and alloy steel per year.

The Uralmash recently began producing quarry excavators with a 5 m^3 scoop capacity. As compared with previously produced excavators (4.6 m^3), they are 15 percent more productive and specific metals-intensiveness is reduced by 15. The savings in metal is 74,000 tons, the equivalent of producing 475 of the old models.

The "VNIImetmash" all-union production association has developed a system for automatically regulating sheet thickness in continuous cold-rolling plate mills. Precision is increased four- to five-fold. It becomes possible to produce sheet in a negative tolerance zone, enabling us to save up to 250,000 tons of rolled metal annually.

Experience shows that 70 percent of the rolled and other metals saved in the branch is accounted for by improved machinery and equipment design and the use

of economical sections and metal substitutes, and 30 percent is accounted for by technological measures in metallurgical and mechanical-assembly production. This past five-year period alone, the weight of many overhead, gantry and portal cranes, load-carrying and push conveyors was reduced. The use of low-alloy rolled metal and curved sections has lowered the weight of rail cars. The rotor complexes of the "Novo-Kramatorskiy Machinebuilding Plant" production association have become more productive and less metals-intensive.

At the same time, as was justly pointed out in the CPSU Central Committee and USSR Council of Ministers decree on thrift and the efficient use of material resources, our industry spends more raw material and energy per unit of national income than the best world indicators. In this regard, heavy and transport machinebuilding is no exception. A number of cranes, drilling rigs, diesels, ball mills and diesel locomotives need further development along precisely this line. Thus, the diesel motors currently being produced by the Riga and Gor'kiy plants are inferior to the best foreign models in terms of fuel and oil consumption and metals-intensiveness. The branch is constantly working to eliminate these shortcomings, and to lower output metals-intensiveness in particular.

In 1981 alone, the State Plan for Economic and Social Development in Industry set the branch the task of carrying out 25 assignments on utilizing highly productive new types of output with lower metals-intensiveness. We shall list only a few. The "Uralmash" production association manufactured walking ESh-20/90 excavators with a 20 m^3 scoop capacity and a 90 meter boom for use in coal quarries with no conveyor-belt system and EKG-20 quarry excavators for use under low-temperature conditions (down to -50°C); the machinebuilding plant imeni F. E. Dzerzhinskiy manufactured 600-kV d.c. diesel generators with a service life prior to major overhaul of 18,000 hours; "Zvezda" production association manufactured 6,800-hp diesel reducers for ships, and the lift-transport equipment plant imeni S. M. Kirov manufactured portal cranes whose development and production earned the collective of designers, engineers and workers the USSR State Prize for 1981.

The branch successfully carried out assignments in eight target comprehensive programs and 17 programs to solve important scientific-technical problems. They included the development and production of:

technical means for mechanizing and automating lift-transport, loading-unloading and warehousing work. We have begun the series production of multipurpose 20-ton rail transport containers and have worked out technical plans for lightweight five- and 10-ton overhead cranes;

high unit-capacity locomotives and highly productive track-repairing machines;

specialized cars for bulk-shipping loose freight such as grain, cement, mineral fertilizers, and so on, and improved passenger rolling stock. This work was awarded the 1981 State Prize;

new comprehensively automated and mechanized metallurgical machinery and units including a ball mill, a 400-ton converter with improved housing fasteners (Cherepovets Metallurgical Plant imeni 50th Anniversary of the USSR), portable 600-ton mixers, and others.

In 1982, ministry production associations and enterprises must carry out 86 assignments on mastering new types of industrial output. We are developing the

following: a mill to hot-roll 5,000 tons of aluminum and aluminum alloy a year; machines for continuous blank casting for the Oskol'skiy Electrometallurgical Combine; a pipe arc-welding unit to make multilayer large-diameter pipe for the Vyksunskiy Metallurgical Plant imeni V. I. Lenin. Walking excavators with scoop capacities of 40 m^3 and 85 m booms and ERP-5250 VS rotor complexes which can handle 5,250 m^3 per hour will be sent to the most important coal pits. Work is continuing on the development of more-powerful, reliable and economical 4,000 hp to 1,200 hp diesel locomotives and more reliable diesel motors and generators.

All this equipment will correspond to or exceed the best world analogs in terms of productivity, specific metals-intensiveness and fuel and electric power consumption.

Resources use must be improved continuously and purposefully. Economists are actively joining designers and technologists in solving this problem. Work is constantly being done in the associations and at the enterprises on refining materials expenditure norms for all types of items being produced. Assignments on lowering expenditure norms are being communicated to the structural subdivisions.

It is time to put into practice a procedure for organizing production so that documents on the introduction of new equipment and technology are signed only after changes have been made in the material and labor normatives of the items.

The ways and means of saving raw material and energy are varied and must be closely linked to the conditions of each enterprise. For example, this work is being done purposefully and is being stimulated morally and materially at the Dnepropetrovsk Metallurgical Equipment Plant, the Yuzhnoural'skiy Machinebuilding Plant, the Barnaul Transport Machinebuilding Plant imeni V. I. Lenin, the "Bryansk Machinebuilding Plant," "Donetskgormash" and other associations. Material expenditures per ruble of commodity output are therefore constantly being lowered at these enterprises. For the ministry as a whole, these expenditures decreased from 54.75 to 53.12 kopecks (by 2.98 percent) during the 10th Five-Year Plan in comparable 1975 prices.

Material incentives are called upon to mobilize economy reserves in the best way possible. This will be facilitated by the regulation worked out by the USSR Gosplan on procedures for and amounts of direct deductions to economic incentives funds for saving material resources in 1983-1985. Given a reduction in material expenditures as compared with approved limits, direct deductions will be made using the savings obtained to incentives funds on a set scale. The proposed material incentives system can not only provide a significant supplement to wages but can also, given poor work and the exceeding of a set limit, tangibly affect worker interests in the opposite direction.

At the present stage, the branch has accumulated a certain amount of positive experience in saving metal: the rolled metal use coefficient for the branch as a whole is 0.79. It has reached 0.86 and 0.81, respectively, in rail car building and lift-transport machinebuilding. However, the branch as a whole permitted an overexpenditure of metal during the five-year period due to its failure to obtain the planned economical sections. The USSR Ministry of Ferrous

Metallurgy, as a rule, meets less than 15-17 percent of the branch demand each year for graded new sections, and actual deliveries (in terms of volume) are even lower. During the 10th Five-Year Plan, enterprises of the Ministry of Heavy and Transport Machinebuilding received only 43 of the required 176 type-sizes.

The Ministry of Heavy and Transport Machinebuilding, together with the USSR Ministry of Ferrous Metallurgy, is currently working out an agreement fixing the utilization and delivery of specific types of higher-quality and economical-section rolled metal needed in 1982-1985. The Ministry of Ferrous Metallurgy has accepted for manufacture only 73 of the 94 type-sizes of needed sections, ensuring a savings of 71,000 tons of rolled metal (instead of the planned 86,000 tons). This means here, too, additional reserves will have to be sought. The production of full rail car axles has been postponed to the end of the five-year plan. Branch enterprises will not be receiving economical sections for distributor shafts, blanks for rolled guide gears and reduction gears, wheel-pair axles, sheet steel needed for rail cars, and so on. As a result, 40,000 tons of rolled metal will be lost to shavings in the machining of heavy metal components.

The ministry has been set taut 11th Five-Year Plan assignments on saving metal -- 1.5-fold higher than assignments in the last five-year plan. Metal resources in the country are calculated with consideration of a prescribed metal savings. The USSR Gosplan has therefore instituted a new system of reporting for each year of the five-year plan. Fulfillment of savings assignments will be calculated relative to 1980, retaining and transferring unmet amounts to subsequent years. Implementation of these assignments will require special branch efforts to mobilize all reserves. Thus, minimal metals-intensiveness allowing calculated strength will be designed into new machinery and equipment. However, the work on mastering and producing equipment permitting a significant metal savings is going slowly. For example, the "Kolomenskiy Plant" production association has developed a progressive diesel locomotive, the TEP-70, which will save up to 1,000 tons of metal a year when replacing the TEP-60; "Novo-Kramatorskiy Machinebuilding Plant" production association has developed the ESh 13/65 excavators, whose productivity is 30 percent higher than previous models but whose specific metals-intensiveness has been reduced by 20 percent. We need to speed up work on introducing them into production.

Another direction is the rapid and active introduction of low-waste technological processes. Blank production must become the primary link in its application, with casting being replaced by welded, welded-cast and welded-forged components. Economists estimate the proportion of progressive rolled metal blanks must be 60 percent for heavy and transport machinebuilding, but this indicator is only 48 percent in the branch today. The USSR Gosplan is not allocating the funds necessary to replace cast blanks with rolled metal. The proportion of casting in modern machinebuilding is gradually being reduced. In the USA, for example, all types of casting of blanks for our type of production comprise less than 18 percent of all blanks; this indicator is 34 percent in heavy and transport machinebuilding here. The high proportion of casting in blank production also determines the significant amount of scrap. Half the metal goes to shavings each year in the branch in machining forgings from ingots. Enormous reserves for saving metal are also hidden here.

A comprehensive plan for saving metal has been worked out and approved in the ministry for the 11th Five-Year Plan. It includes savings through improvement in technological processes and in the machinery design, expanding the use of higher-quality rolled metal and metal substitutes. But additional reserves must be sought even in this saturated program in order to meet the assignments set.

The new system of planning and stimulating material resources savings will "urge on" managers and force them to be more thrifty.

Saving fuel-energy resources is also of important significance. The branch met the basic assignment for saving them in 1981. The 1982 assignment is even more taut.

It will be impossible to meet simply by eliminating losses of steam and air or by turning off electricity promptly. As was correctly pointed out in the speech by CPSU Central Committee General Secretary L. I. Brezhnev at the 26th Congress and the November (1981) CPSU Central Committee Plenum, we need to develop and introduce energy-saving equipment and technology.

Branch technological planning institutes are faced in the current five-year period with working out concrete technological processes which lower specific energy-resources expenditures. Among them are: preheating charges, using oxygen to accelerate smelting in furnaces, recovering preheated air in thermal furnaces, using evaporating cooling from blast furnaces, and so on.

The use of recovered energy resources in heavy and transport machinebuilding is associated with the use of blast-furnace and heating-furnace exhaust gases in metallurgical production. We plan to set up five or six recovery boilers at existing production facilities before the end of the five-year period. No new facility being built will be accepted for operation without maximum use of recovered energy resources, including ventilation exhaust heat.

The effectiveness of branch operation, as of all industry, depends to a definite extent on the efforts of the economic services. Work on the efficient consumption of raw and other materials must find concrete expression in lower output net cost. It is the task of the economic services to constantly reveal through systematic analysis reserves for lowering expenditures and to direct them into achieving end results.

The economic services of associations and enterprises have already begun working out maximum material expenditure norms to be approved, beginning in 1983, for all all-union production associations and enterprises. Much preparatory work is now being done to improve output net cost planning, foremost for basic shops, in order that expenditure normatives for materials, semifinished products and labor expenditures will be known, their fulfillment monitored, deviations recorded and saving encouraged.

A sample check run last year by the NIIekonomiki [not further identified], jointly with the ministry economic planning administration, showed that net cost reduction indicators at the enterprises surveyed were generally communicated to the basic shops, and lowering net cost was monitored in a cross-section of basic technical-economic factors. At the same time, there were deviations

leading to the distortion of actual net cost. Consolidations of articles in planning and reporting shop calculations of units of output were permitted. The item "Raw and Other Materials" sometimes included large assembly components and semifinished materials. Moreover, transport-procurement expenditures were also included. Or auxiliary materials often were not put into that expenditures item. All this distorts true net cost. The ministry economic-planning administration is helping enterprises reveal "mistakes" promptly and eliminate them.

Actually obtaining a materials expenditures savings in output net cost depends to a considerable extent on rate-setting. Calculations of expenditures on raw and other materials, purchased items, fuel, energy, production servicing and management basically correspond to the norms. But there are isolated deviations. There is consequently work yet to be done in the technological services. A definite savings reserve is concealed in that work.

Lowering materials expenditure norms demands planned, purposeful work. Not all enterprises are confining themselves to the established assignments. But that is also being hampered by failures to meet delivery contracts. There has been a rolled-metal overexpenditure at a number of enterprises due to deliveries of more thick sheet than plants have ordered to enterprises of the USSR Ministry of Ferrous Metallurgy. Effective monitoring of materials expenditure limits has not been properly set up everywhere.

One way of lowering net cost is to save labor resources in every way possible, which is concretely expressed in a constant lowering of wage expenditures per ruble of output produced. Wage expenditures per ruble of output generally drop at enterprises where economists constantly monitor proper expenditure of the wage fund.

The branch has enlisted 28 laboratories, bureaus and economic analysis groups and 775 public economic analysis bureaus in improving the effectiveness and efficient use of production resources.

It is impossible to lower net cost without constant improvement in the technical level of production proper. Last year, 32 assignments were carried out on introducing advanced technology, equipment, means of mechanization and automation, automated control systems and computer equipment. The mechanical assembly production facility mastered three automatic lines and 38 comprehensively mechanized sectors and lines; the welding production facility mastered 11 installations for plasma-cutting rolled sheet.

We have introduced 14 industrial robots, of which there will be a total of 40 in the branch by the end of the year. They are used in machining, stamping and painting items. Some 160 balanced ShBM-150 manipulators were introduced during the year. Of course, the use of industrial robots is associated with considerable change in existing technological processes, and much work still faces us along this line. The ministry assignment for introducing industrial robots in 1982 is double its 1981 assignment. These assignments will grow in subsequent years. We are faced with switching from the introduction of individual robots at individual workplaces to their broad application in developing robotized lines and sectors. All this has been reflected in the branch program for developing robotized sectors this five-year plan.

The branch is successfully mastering qualitatively new technological processes. Plasma is being used to process rolling mill rollers and crusher casings at the "Uralmash," "Zhdanovtyazhmash" and "Elektrostal'tyazhmash" production associations. The "Novo-Kramatorskiy Machinebuilding Plant" production association has put into industrial operation the first line of a 7,500-ton electroslag resmelting shop and has put a unique EShP-150 furnace into experimental industrial operation. Their operation will enable us to manufacture improved rollers, using worn rollers returned from metallurgical plants as electrodes.

We anticipate the expanded introduction of progressive technology, equipment and means of mechanization and automation. Thus, blank production will introduce 24 automatic lines and forging-pressing, foundry and welding production will introduce 13 automated manipulators with preset control, 23 automatic electroplating machines and 51 installations for plasma-cutting and spraying powder coatings.

In view of the fact that progressive new equipment and technology ensure a significant savings of metal, natural gas, oxygen, electric power, as well as freeing workers for other tasks, organizational work is being done in the branch to ensure unconditional fulfillment of this program. In order to do this, we will need to mobilize all the creative forces of the thousands-strong branch collective. Only on this condition will we best be able to reveal and use the available reserves and opportunities.

11052
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AUTOMATED LINE FOR ROLLING BILLETS FOR METAL-CUTTING MACHINE PARTS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 6, 1982 (signed to press 21 May 1982) pp 1-3

[Article by P. M. Finagin, Candidate of Technical Sciences, D. V. Terent'yev, engineer, M. N. Ayzenberg, Candidate of Technical Sciences, Yu. V. Neklyudov, engineer, and Ye. P. Vasil'yev, Candidate of Technical Sciences: "Automated Line for Rolling Billets for Metal-Cutting Machine Parts"]

[Text] One of the most important tasks the 26th CPSU Congress set our machine builders is that of reducing the metal content of their products and of introducing low-waste technology. The system of equipment for rolling metal-cutting machine components designed by the Elektrostal'tyazhmash production association will help accomplish this task.

What is being proposed here is to centralize in one of the country's enterprises the production for machine-tool manufacturing plants of billets for the following types of machine-tool components: tail spindles and sleeves (a thin round tubular billet), shafts without aperture (round tapered billet), flangeless tubular shafts (round tapered tubular billet) and flanged tubular shafts (round tapered tubular billet with upset end).

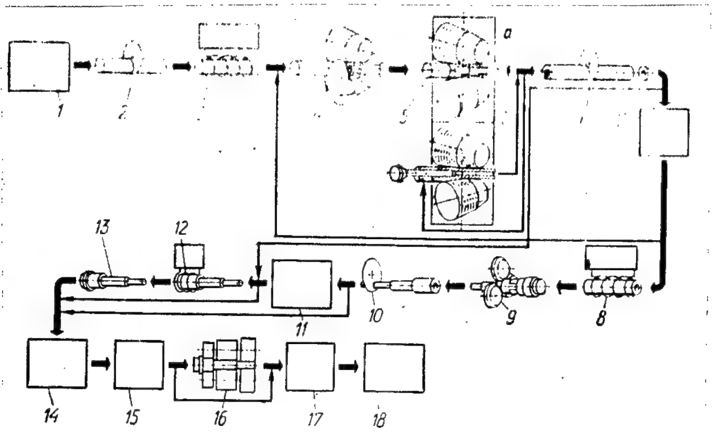
Each machine-tool manufacturing plant now makes these components for itself in small-scale forging and machining (drilling, turning) operations.

The process of producing billets using the new system of equipment consists of the following basic operations (see figure): induction heating of solid round billet; rolling of billet in a special three-roll machine with simultaneous centering; broaching into a thin sleeve on a special-purpose two-high cross-helical rolling mill and, if necessary, reduction of the sleeve on the same mill; induction heating of solid round billet or thin sleeve; deformation of solid or tubular billet into tapered component on a three-high cross-rolling mill; heat treatment and straightening on a straightening and gaging machine.

The problem of producing relatively short, thin sleeves and other components varying in shape with a precision exceeding 1.5-2 times that of hot-rolled pipe based upon current standards has in turn required the solution of a number of engineering and design problems.

Specifications of Rolled Products

Initial billet, mm:	
diameter	80-230
length	840-1710
Billet after rolling, mm:	
diameter	72-224
length	890-1745
Sleeve after broaching, mm:	
exterior diameter	70-216
interior diameter	33-152
length	1640-2560
Sleeve after reduction, mm:	
exterior diameter	80-202
interior diameter	26-66
length	1920-2260
Billet (solid or tubular) for cross rolling:	
exterior diameter, mm	50-200
length, mm	300-1100
shaped piece, mm:	
exterior diameter	45-200
length	418-1700



Flow diagram of automatic line: 1 - billet storage; 2 - bars cut into uniform lengths; 3, 8 - billets heated; 4 - billets rolled and centered in three-high helical rolling mill; 5 - helical rolling in two-high mill (a - broaching; b - reduction); 6 - ends cut off and sleeves cut into uniform lengths; 7, 11 and 14 - intermediate storage; 9 - - solid and tubular billets cross rolled; 10 - front end cut off; 12 - flange upset heating; 13 - flange upset; 15 - heat treatent; 16 - straightening and gaging; 17 - - cooling, inspection, repair, control; 18 - - finished product storage.

Preparing the billet for broaching. The precision of geometric sleeve dimensions is to a great degree a function of the quality with which the billet is prepared for broaching. The primary process requirements here are that scale be removed, warp be eliminated and that we obtain the proper geometric dimensions and achieve high centering accuracy.

A machine consisting of a three-roll helical-rolling pass and a punch in the form of a broaching mandrel aligned with its axis. The punch is linked to a system of levers offsetting it from the axis of the pass and is fitted with a cam gear set so as to permit interaction with the system of "breaking" levers.

The heated billet enters the system receiving chute from which by a pneumatic pushing device it is fed to the pass, formed here by three drive rolls. During the helical rolling process, the punch, located between the rolls along the axis of the pass, spins out a center hole in the end of the billet. The punch is then quickly shifted off the axis of the pass, thereby allowing room for the billet to pass through. The billet, now worked along its entire length, is then fed to the input side of the broaching mill.

This system substantially improves billet surface quality, increases the precision of the geometric dimensions and the working of the structure and increases the output of suitable centering holes, running for all practical purposes precisely along the axis (with an eccentricity of 0.2-0.6 mm) and, accordingly, the production of high-precision sleeves.

System Specifications

Roll diameter in gorge, mm	320-350
Length of roll barrel, mm	300
Angle, deg:	
of rolling	5
of feed	6-12
Force on roll, ton-force, not more than:	
radial	30
axial	10
Roll rotation frequency, rpm, not more than	72
Torque per roll, tfm, not more than	1

Cross-helical rolling on two-high mill. Solved for the first time in Soviet practice in the process of designing the broaching mill has been the problem of producing thin sleeves with a ratio of D/S<5 and a small interior aperture diameter (up to 33 mm) by cross-helical rolling. D - exterior sleeve diameter; S - sleeve wall thickness. The new production process involves broaching the billet on a two-high helical rolling mill equipped with guide wheels and an output side providing enhanced rigidity in the sleeve-mandrel-shaft system and reduction of the sleeve on the same mill over a range of large feed angles.

The billet is broached into a sleeve on a mandrel regulated in the axial direction relative to the roll gorge by the drive carriage of the thrust-regulating mechanism. The working rolls and the disks (liners) form the pass required to produce sleeves of the desired diameter. The mandrel rod is kept on the axis of rolling by the centering rollers of the centering device, one of which is designed to permit lateral output of the broached sleeves. Axial rolling forces are absorbed by the thrust-regulating mechanism, the head of which interacts with the conical end of the rod.

To produce sleeves with an interior diameter of less than 50 mm the rod is mounted in a special centering bushing, which increases the rigidity of the rod and its stability during the broaching process. The centering rollers are in this instance brought together in a bushing, thereby insuring that the rod is reliably centered with the mandrel relative to the axis of rolling.

The process by which a solid billet is broached into a sleeve takes place as follows. After being rolled and centered the billet is fed to the front table and then advanced by the pneumatic pushing device to the rolls of the working stand, in which it is broached into a sleeve on the mandrel. During the broaching process, the front end of the sleeve advances the bushing (in the case in which we are producing sleeves with d_{in}<50 mm). In this instance the centering rollers of the centering devices open in sequence to pass the sleeve and then come together to center it.

Upon completion of the broaching process the head of the thrust-regulating mechanism opens, and the sleeve is fed by distributing rollers past the mill line to a roller conveyor, which advances it to the cross rolling mill for further processing. All mill mechanisms then return to their initial positions to broach the next billet.

If sleeve reduction is the operation following broaching, the cross-helical rolling process in the two-high mill occurs as follows. The sleeve, produced in the manner described, is held in the axial direction on the output side of the mill. The mandrel rod is then withdrawn from the sleeve by the distributing rollers, after which it is fed together with the bushing past the mill line to the conveyor. Completion of the process of withdrawing the mandrel rod from the sleeve is the signal for separation of the centering rollers of the lateral-output centering device; the sleeve rolls down

the inclined planes of this device away from the axis of rolling to the receiving and conveying mechanisms of the mill. By the time the sleeve is fed to the forward table of the output side of the mill, on which is mounted the thrust mechanism with the manrel rod passed through it, the latter with be in the rearmost "from stand" position. After the sleeve is fed to the forward table, the master rollers come together on the mandrel rod and, passing it through the sleeve, position the mandrel in a predetermined manner relative to the gorge of the working rolls. The rod in this instance rests with its inverse taper against the corresponding cone of the shaft of the thrust mechanism. The pneumatic pushing device then feeds the sleeve to the deformation area of the working stand, which has been preadjusted for reduction.

During the rolling process the rod works for extension, while axial loads are absorbed by the thrust mechanism. As it emerges from the stand the tube to be reduced is centered by the guides and the centering rollers of the centering devices. When the process is completed the rollers of the centering mechanisms separate, and the reduced tube is fed out of the axis of rolling to distributing devices and then to a take-off roller conveyor to the cross-rolling mill or to storage.

When the output side of the mill is free all mechanisms and the tool return to their initial positions to broach the next billet into a sleeve.

The mill can function in either the automatic or manual modes.

Mill Specifications

Force on roll, ton-force, not greater than:	
radial	100
axial	40
Torque on roll, tfm, not more than:	15
Rate of roll rotation, rpm ..	37.5
Roll diameter in gorge, mm ..	700-800
Length of roll barrel, mm ..	500
Roll angle, deg	8
Disk diameter, mm	1350
Force on disk, ton-force:	
radial	60
lateral	30

Workpiece rolled on cross-rolling mill. The cross-rolling mill is designed so as to permit operation from one of two heating units depending upon the range of diameters involved in the batch of workpieces to be rolled. The billet heated to rolling temperature is fed from a heater to a lever of the automatic manipulator in initial position. Pneumatic grippers grasp the billet, and it is moved to the rolling line by the rotation of the automatic manipulator lever, after which the feed mechanism drive is actuated and the chuck approaches the billet. The mandrel advances simultaneously from its initial position; it is lubricated and passed through the billet. At operating speed the chuck on the feed mechanism by its anvil pushes the billet, 20-30 mm of which is held by the automatic manipulator; the billet is thus positioned in the axial direction. The feed chuck jaws then grip the billet; the automatic manipulator's gripping clamp releases the billet and returns to its initial position. The billet then accelerates to the rolls; before reaching the feed rolls it is advanced to operating speed. After the billet enters the deformation area the rolling process begins with the billet supported to the end. The rolls produce workpieces of the required shape by means of an electrohydraulic servo system with program control.

Upon completion of rolling with the support, the direction of the billet feed is reversed and the workpiece sized with respect to the elongation scheme. At the end of

the sizing cycle the mandrel is withdrawn from the billet and held by the mandrel rest; the workpiece is placed on the workpiece rests, gripped by the clamping grip of the automatic manipulator and, after the billet chuck returns to its initial position, is advanced for subsequent process operations. The process of rolling solid workpieces will exclude operations employing the mandrel.

Unit Specifications

Roll diameter, mm	300-480
Axial rate of feed, mm/min ...	1000-3300
Rate of roll rotation, rpm ...	120-170
Radial force on roll, ton-force, not more than	45
Axial force on roll, ton-force, not more than	15
Torque per roll, kgm, not more than	1600
Angle of roll rotation, deg ..	Up to 6

The workpiece is straightened on a straightening and gaging machine. Heated to a temperature of 700°C, a workpiece varying in shape is grasped by the clamping grippers of the automatic manipulator and positioned on the lower support rollers of the working stand. The feed and rotation chuck advances toward the workpiece and grips the front end of it. The upper rollers of the screwdown mechanism drop down on the workpiece. As the upper rollers approach the workpiece, the latter begins to rotate. During the straightening process the workpiece is repeatedly moved axially 10-35 mm. When the straightening process is completed the workpiece stops, the automatic manipulator opens its grippers, the upper rolls withdraw, and the workpiece, held by the manipulator clamping grips, is withdrawn from the working stand.

Straightening and Gaging Machine Specifications

Force developed by each pressure cylinder, ton-force, not more than	102
Rate of rotation of chuck end, rpm, not more than ..	250
Temperature, deg:	
at start of straightening	700-730
at completion of straightening	550-600

Introduction of this new system makes it possible to replace the processes of forging and then maching with the more efficient and economical process of rolling billets with minimum allowances and approximating the shape of the finished piece. This will save 6000 tons of metal each year, reduce the labor intensity of the involved 4-fold and free up more than 200 workers. The annual economic gain to be achieved from introducing this line will run to some 3 million rubles.

8963
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UDC 621.316.1

NUMERICALLY CONTROLLED MACHINE TOOLS IN SMALL-SCALE, SINGLE-UNIT PRODUCTION

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 2, 1982 (signed to press 2 Apr 82) pp 8-9

[Article by V.G. Gontarev and L.A. Medvedev, engineers, Moscow Elektrozavod Production Association imeni V.V. Kuybyshev: "Experience of Using Machine Tools with ChPU [Numerical Program Control] at Small-Scale- and Single-Unit-Production Enterprises"]

[Text] For the effective introduction of machine tools with numerical program control in a production association, an investigation was made of machine assembly production, a technological analysis was made of a long list of parts (tens of thousands) and recommendations were prepared on preparing an enterprise for receiving new equipment.

Shop documents characterizing the number of parts made over a certain period of time by lathe, milling machine, drilling machine, boring machine and other machine tool operators were used as the source documentation. Sets of diagrams were selected from lists obtained for these documents. On each diagram data were entered on the worker's category, time standards, estimates and lot size. The diagrams prepared were finally sorted into sets of lathe, milling, drilling and boring operations. By means of the sets of diagrams produced the provisional number of required machine tools with numerical program control was calculated.

For the purpose of learning the nature of equipment utilization in a shop, the method of instantaneous observation was employed, when every day at the same time rounds were made of the shop and one of three possible states of a machine tool was recorded: operation through an entire shift, operation for an incomplete shift and idleness for an entire shift.

The data obtained made it possible to substantiate which of the machine tools present in a shop could be done without in case new ones were required with more general-purpose technical characteristics.

In order to provide for possible changes in the division of labor when using machine tools with numerical program control, by means of photographing the work day a determination was made of the structure of functions of machine tool operators when using ordinary machine tools. It was established that work time is spent under conditions of small-scale production not only on controlling the machine tool, but also on delivery of parts, tools, attachments and technical documentation,

on hand finishing of parts, on computations in adjusting the SPID system [system for feeding tools and parts] and in measuring, on eliminating machine tool malfunctions, etc. Thus, breaking down the work process into individual functions made it possible to reveal the requirements for the redistribution of duties among participants in the production process with its new organization.

The system of planning and control in a shop also imposes its requirements on the use of machine tools with numerical program control. Its features were studied by means of shift assignments and indications of their fulfillment. On the basis of this documentation charts were constructed of the completion of assignments by machine tool operators by day of the month with an indication of the day the assignment was issued by the controller, the time taken and the day the job was handed over. These charts made it possible to reveal variation in the dimensions of a batch of parts, starting priority, unscheduled work, the length of operation cycles and certain other indicators making it possible to introduce refinements into the characteristics of representative parts.

For the purpose of making an analysis of equipment planning, observation of the flow of batches of parts through work places was established, as well as of the utilization of cranes, telphers, trolleys and the rack and case storehouse, and an analysis was made of the purpose and use of pedestals, tables, shelves, packing cases and the like. As a result of the analysis a detailed pattern was revealed for the distribution of equipment and freight traffic, which served as a source for future planning of machine tools with numerical program control.

A great advantage is bestowed by acquaintance with the operation of machine tools with numerical program control at other plants at the stage when initial data for ordering machine tools with numerical program control have already been obtained. This makes it possible to make a precise determination of machine tool models selected and of the number and composition of operating personnel, to designate the division of functions among plant services at the introduction and operation stages and to solve a number of other problems.

In becoming acquainted with finished plans for automated machining sections under conditions of small-scale production, it was established that in connection with the specifics of the plant it is not possible to use existing plans for totally automated sections. The main difficulties are the lack of free production space for creating an independent section; lack of the appropriate training of plant services; the methods of planning, organizing and controlling production used at the plant; and a volume of machining insufficient for total utilization.

Therefore, for the purpose of training the engineering services of the plant for the receipt of machine tools with numerical program control, a plan was developed for training in individual courses representatives of the chief production engineer's, chief maintenance engineer's and chief power engineer's departments. Each representative was given an independent assignment so that after training he would be able to prepare specific recommendations for his service.

The conclusion regarding the equipment needed is made on the basis of all production features revealed. The list of required equipment must include, in addition to machine tools with numerical program control, software, machine tool attachments,

auxiliary and cutting tools, equipment for mechanizing and automating ancillary operations, managerial aid equipment and the like.

The revealed distinctive features of an enterprise also determine the procedure and dates for introduction of machine tools with numerical program control. For example, machine assembly production at the Moscow Electrical Equipment Plant imeni V.V. Kuybyshev is being retooled with machine tools with numerical program control during the current five-year plan period in terms of a few machine tools per year, beginning with lathes.

Thus, the completeness of the development of initial data for introduction of machine tools with numerical program control in small-scale and single-unit production depends almost entirely on the enterprise itself, on its approach to this question. It is necessary to keep in mind that it is usually simpler to train an enterprise's specialists in the principles of numerical program control than for specialists invited from other organizations to grasp the essentials of all the intricacies of production at a given enterprise for the purpose of making a specific decision.

8831
CSO: 1821/182

METALWORKING EQUIPMENT

UDC 621.91:62-503.55

INTRODUCTION OF NUMERICALLY CONTROLLED MACHINE TOOLS AT ZHITOMIR PLANT

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 2, 1982 (signed to press 2 Apr 82) pp 23-24

[Article by M.I. Leshchenko, chief engineer: "Experience of Zhitomir Automatic Machine Tool Plant in Introducing Machine Tools with ChPU [Numerical Program Control]"]

[Text] Various kinds of equipment with ChPU are being used successfully at the Zhitomir Automatic Machine Tool Plant. The operations performed on them differ fundamentally from operations performed on machine tools of the ordinary design and of the same class.

The advantage of lathes with numerical program control which are used increases with complication of the machining and reduction of the lot of parts, as compared not only with general-purpose machine tools, but also with machine tools with cyclic program control, whose adjustment requires considerable input of time.

A distinctive feature of the drilling machines which numerical program control used is the presence of a coordinate table which makes it possible to eliminate jigs and special clamping attachments.

Machine tools with number indexing are used in performing boring operations on a large batch of parts which have several holes each and require considerable input of machine time. It is feasible to use machine tools with ChPU only for performing boring operations when making small lots of parts.

Milling machines with numerical program control make possible economy in machining a part. Here movement of the machine's table as well as of the tool is programmed. Machine tools with multispindle swivel heads making it possible to carry out the operations of drilling, milling, boring, etc., can be used especially effectively.

The advantage of multi-operation machine tools (machining centers) is the ability to perform drilling, milling, boring and other kinds of machining on a single unit, which makes it possible to improve the quality and reduce the cost of parts because of automatic tool replacement.

Thus, the main savings of time in working with machine tools with ChPU is made possible on account of the use of standard cutting tools, general-purpose assembly jigs and clamping devices. Here the possibility is provided of machining the

most complicated parts and of eliminating the making of special equipment.

Input of time is considerably reduced when a machine tool is so adjusted that the tool is installed an amount outside of it and the parts to be machined are placed on satellites.

Experience in using machine tools with ChPU has demonstrated that their effective use is made possible both by engineering methods and organization measures, in particular, by the proper planning and preparation of production.

For example, in introducing the first machine tools an important factor is reconsideration of traditional ideas regarding the production process and organization. The plant's chief production process engineer must select typical parts, for which the appropriate machine tool model is selected, having first evaluated the feasibility and effectiveness of its use. After the machine tool has been singled out, the chief mechanical engineer and chief power engineer of the plant obtain the data necessary for carrying out preparatory work--the overall dimensions of the machine tool, its weight, power supply requirements, compressed air and water requirements, foundation requirements, etc.

Small machine tools, machine tools of normal accuracy weighing up to 5 tons (e.g., the model 2N135F2 upright drilling machine, model 6R13F3 milling machine, the model 16K20F3 screw-cutting lathe) can be installed on vibrosupports on a common base. A machine tool designed for processing high-precision parts (e.g., the 243VMF2 drilling and boring machine, the model 6906VMF2 milling-drilling-boring machine, etc.) it is a good idea to install on isolated foundations taking into account such negative factors as dust, variations in temperature, increased humidity, etc.

The experience of mastering machine tools with ChPU has demonstrated the urgent need to train personnel for attending to them.

Machine tools with ChPU have certain features both with respect to design, hydraulics, control system and programmed processing of parts and with respect to the use of cutting tools, jigs, metal-cutting process, etc. For their study and mastery it is advisable to choose people who have experience in working on general-purpose machine tools. This is especially important at the beginning of the mastery of machine tools with numerical program control.

In selecting specialists it is necessary to take into account their practical experience and technical training in the area of machining metals and operating machine tools, including in the field of hydraulics.

Appropriate retraining of personnel was carried out at the plant, which justified itself economically. For example, in spite of the introduction each quarter of an additional six to eight machine tools with numerical program control, the utilization factor equaled 0.7 to 0.85, the shift factor 1.7 to 1.8 and the multi-machine factor 2.1. The savings from introducing machine tools with ChPU equals hundreds of thousands of rubles.

8831
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METALWORKING EQUIPMENT

ROUNDTABLE DISCUSSION AT MINSK STATE BALLBEARING FACTORY NO 11

Minsk PROMYSHLENNOST' BELORUSSII in Russian No 4, Apr 82 (signed to press 23 Mar 82 pp 6-13

[Article: "The Collective's Rule of Life"]

[Text] Minsk State Ballbearing Plant No 11 is one of the most metals- and energy-intensive enterprises in the republic. Average annual metal consumption here was 110,000 tons in the 10th Five-Year Plan. Fifty supplier plants provide it with more than 70 types of rolled and other metal items. Average annual electric power use is also significant -- 170 million kilowatt-hours. The enterprise collective perceives the CPSU Central Committee and USSR Council of Ministers decree "On Intensifying the Economical, Efficient Use of Raw-Material, Fuel-Energy and Other Material Resources" as a mandatory guide to action. A reliable foundation for carrying it out has been created here. This past five-year plan, for example, given 32.1 percent production growth, the plant hardly increased its consumption of metal and electric power. Some 9,200 tons of ferrous and 964 tons of nonferrous metal was saved over the five years by introducing organizational-technical measures and reviewing norms. These successes were achieved foremost through the recently-begun blank production facility retooling and the introduction of new equipment and progressive technological processes. Many organizational-technical measures and socialist competition are aimed at the thrifty use of materials this five-year plan. We are creating 26 multipurpose creative economy brigades. A system of moral and material incentives has been worked out. Saving, large and small, is a rule of life for the collective. In addition to metal and electric power, it has saved considerable additional materials -- fuel, petroleum products, and so on. Thus, 2,400 m^3 of wood was saved annually by using corrugated cardboard instead of lumber for packaging bearings. The economic impact of introducing efficiency proposals was 2.57 million rubles. We offer our readers a selection of materials discussing the work experience of the GPZ-11 [State Ballbearing Plant No 11] on the thrifty use of materials and labor resources.

Through New Technology (G. Tishurov, deputy chief technologist)

Let's begin with the fact that reducing metal expenditures by just one percent provides the plant with more than 1,000 tons more annually, worth 250,000 rubles.

In recent years, we have paid particular attention to introducing technical resolutions which ensure significant growth in the metal use coefficient when manufacturing bearing parts in individual design groups. At present, for example, 73 percent of our high-quality universal-joint bearing race blanks, with allowance for grinding, are manufactured using branch-leading cold-extrusion technology using automatic lines. Introduction of this process to replace turning enabled us to raise the metal use coefficient from 0.26 to 0.7.

Changing over spherical roller-bearing race blank production to automatic flow lines instead of open forging or stamping on upsetters (GKM), with subsequent rolling, makes a major contribution to saving metal. GKM stamping technology is characterized by low productivity, the use of manual labor and a low metal use coefficient. Moreover, repeated heating of the bars in reverberatory furnaces for GKM stamping increases high-temperature scaling, necessitating the removal of additional metal during machining. These same shortcomings are inherent to an even greater degree to open forging.

We therefore adopted a policy of retooling the forging-stamping facility, which works up to 50 percent of the metal used by the plant. In particular, raceway stamping has been transferred to a mechanized flow line. The metal is now heated by high-frequency current, the race blanks are stamped with the necessary feed of metal weight, and the automatic rolling is done on full sections, with reduced tolerances. The mechanized flow lines are equipped with means for mechanically moving the forgings along technological transfers. After mastering their planned capacity of 12,000 tons of forgings, the plant will be able to save 900 tons of metal yearly and forgings made on these lines will be more precise, reducing the labor-intensiveness of subsequent turning by 10-15 percent.

The constant search for economy reserves is a landmark of our work. For example, the plant uses about 17,000 tons of rolled metal annually (metal use coefficient, about 0.6) to manufacture rollers. Naturally, a significant portion of that metal is going to scrap. They therefore decided to switch the manufacture of rollers in the broad "up to 25 mm diameter" products list from automatic multispindle lathes to cold-upsetter presses. Five such presses have already been installed. With their start-up and reaching planned capacity, 67-70 percent of the rollers will be stamped, providing an opportunity to raise the metal use coefficient to 0.83 and save up to 500 tons of metal a year.

Much work is also being done on improving technological fittings and cutting tools for turning bearing parts and on introducing new lathe equipment which enables us to improve machining precision, lower tolerances and, in so doing, save metal. Thus, improving the design of chucks used in turning races provided a savings of 80 tons of metal a year and shearing ballbearing races on multispindle automatic lathes using special discs instead of shearing blades enables us to save up to 60 tons of steel pipe.

Nonferrous metals are a particular concern of ours. In the 10th Five-Year Plan alone, we saved 950 tons of brass by lowering tolerances in centrifugal pipe casting when manufacturing retainers.

Reworking commercial scrap to manufacture bearing parts and consumer goods is very important. We use 90 percent of the >75mm hot-rolled end scrap generated by the forging shop (about 5,000 tons annually) to produce basic production parts (roller bearing races). We manufacture a total of 20 type-sizes of races from scrap. And it is not just end scrap, but also scrap from race blanks. Moreover, we use about 900 tons of circular stamping blank generated in half-retainer stamping to make basic production parts and consumer goods. We are now assembling a products list of new consumer-goods items in order to increase the use of circular steel tape stamping blank.

During the 10th Five-Year Plan as a whole, 8,250 tons of metal was used to produce consumer goods. Some 95 percent of it was scrap metal. Both scrap we produce ourselves and scrap from other enterprises are used to produce consumer goods.

In the 11th Five-Year Plan, we plan to use 11,500 tons of sheet-rolled scrap metal to produce consumer goods, 45 percent more than in the preceding five-year plan.

Scientists also make an important contribution to solving these problems. Thus, a new technological process for manufacturing spherical roller bearing parts by pressing them from metal powder instead of casting iron pipe and then turning it has been introduced for the first time in our branch as a result of joint work by plant specialists and the Belorussian Powder Metallurgy Scientific Production Association. This has enabled us to eliminate some iron pipe casting, eliminate some turning and lower the labor- and metals-intensiveness of its manufacture. Thanks to introduction of the new method, more than 200 tons of cast iron was saved last five-year plan (previously, 70 percent of the metal went to shavings); defects have been reduced to a minimum, which is now 35 percent for cast-iron production, incidentally.

Jointly with scientists from Zaporozh'ye, we have worked out and introduced into production a progressive method of pressure-casting aluminum alloy needle-bearing retainers, enabling us to save 28,200 rubles and 200 tons of scarce aluminum pipe. Leningrad scientists are participating in the development and introduction of a technological process for cold-upsetting bearing clamp couplers. Several agreements have been concluded with scientific research organizations on technical cooperation in solving problems associated with production scrap metal use. The overall savings for all types of metal used this five-year plan must be 13,700 tons, and the metal use coefficient is to be increased from 0.5 in 1980 to 0.566 in 1985. The main reserve is the replacement of obsolete technological processes by more progressive ones.

We first plan to expand the displacement cold stamping of universal-joint and needle bearing race blanks on automatic lines, introduce cold upsetting of spherical and spherical-roller bearing races (metal use coefficient will be increased by 40 percent and the savings will be 400 tons of metal a year), complete experimental research on and introduction of a technological process for butt cold rolling semifinished pipe bearing clamp couplers (metal use coefficient will increase 1.5-fold), introduce roller stamping on "Malmedi" presses to replace turning, with a reduction in subsequent grinding operations, and so forth. Moreover, the products list of bearing parts manufactured using metal

powders will be expanded, saving 1,300 tons of cast iron a year, and we will manufacture bearing parts and consumer goods using polymer materials. Much will also be done to improve metal use by lowering the specific metals-intensiveness of the bearings and improving their operating qualities and characteristics, especially their load capacity and durability, as well as to make broader use of progressive types of rolled metal and economically profitable sections.

Reducing losses due to defects is also of considerable importance. During the five-year period, they will be reduced by 25 percent. To this end, we anticipate improving the technology for machining metals, to modernize 300 pieces of technological equipment and to introduce quite a bit of new equipment.

Thrift in Using Energy Resources (A. Simanchuk, chief power engineer)

Energy resources at our plant comprise about seven percent of the net cost of the output produced. The main reserve for saving them is the replacement of obsolete technological processes with more progressive ones using less energy-intensive processes, introducing efficient energy-supply flow patterns and improving their reliability, using recovered energy resources, and so forth.

A typical example. Introducing new technology for turning races with roller tracks turning in a channel enabled us to save 180,000 kW-hr of electricity. By introducing technology for heating forgings in furnaces for less time, we saved 600,000 kW-hr. Replacing machine frequency transformers with thyristor voltage limiters and using new insulating materials provided a big savings. The plant heating lines were also renovated, enabling us to save 1,200 gCal. We are now recording electric power use by shop and energy-intensive unit. We have begun introducing shop recording of thermal energy and compressed air.

An energy use commission operates at the plant. Equipment using energy inefficiently is immediately switched off. Inspection results are published in the plant newspaper and are reviewed in the people's monitoring committee and the plant energy-use staff. The commission's functions also include determining the energy use coefficient for each plant subdivision, which is taken into account when summing up socialist competition results.

In order to take effective steps during periods of peak load and to monitor the efficient use of energy resources, a fuel-energy resources use bureau and a group of on-duty engineers have been attached to the chief power engineer's department. A continuous review-contest for best work organization on efficient fuel-energy resources use and best efficiency proposal has also been set up in the shops and departments. A system of plant-worker bonuses stimulates efficient energy use.

The result of our efforts has been a 16 percent reduction in specific electric power expenditure per 1,000 rubles of output as compared with 1975.

Have all savings reserves already been used? No, not all. Thus, some shops in the roller-bearing group are working unevenly, compressed air losses are high in the forging shop and there have been cases of technology violation. In a word, the problem of reducing fuel, water, electric power and compressed

air expenditures to a minimum is still on the agenda. During the five-year plan as a whole, we plan to save 15 percent on electric power, seven percent on thermal energy and six percent on fuel.

These are not, to put it bluntly, easy tasks. We link their successful resolution to the continued introduction of technology for manufacturing parts using powder metallurgy. This will permit a several-fold reduction in labor intensiveness and energy resources expenditures. We also place great hopes on an automated system of recording energy and traffic control of the plant's energy supply.

Improving Tool Reliability (P. Astapenko, tool department head)

Improving tool life and reliability is one way to save. Judge for yourself: our plant uses about 400,000 cutting-tool units manufactured using various brands of expensive steel and hard alloys each year, totalling upwards of 700,000 rubles.

What, specifically, are we doing to save?

Extensive use is being made of technology for rebuilding tools by resharpening from type to type or to another type. We have introduced a technological process for electrodiamond working hard-alloy tools. The economic effectiveness is 20,000 to 25,000 rubles.

Last year, we began introducing technology for vacuum-plasma coating tools with titanium nitrides using a "Pusk-79." We set up the working of blade, drill and tap fragments used to manufacture bearing parts. The life of cutting tools coated with wear-resistant elements has been increased two- to three-fold in individual operations.

We will be expanding this work. We are now putting into industrial operation a facility designed to apply strengthening coatings of the TiN and $M_{02}N$ type to hard-alloy high-speed and tool steel tools by condensation and ion bombardment in a vacuum.

As distinct from the "Pusk-79," the new device has three arc vaporizers, two situated horizontally in the chamber, which enables us to apply the coating to parts in a rotating position; the third vaporizer is situated vertically, on the chamber's upper plate, and applies the coating to parts clamped on an immovable platform. The working zones of the vaporizers inside the chamber are separated by removable shields.

Introduction of this device will enable us to broaden the products list of cutting tools, stamp and press-mold parts being treated and to use less of them.

The production of plastic bearing parts and consumer goods and of pressure-cast aluminum retainers poses a complex organizational-technical task to the plant tool service, that of manufacturing high-precision press-molds of complex design. To this end, we have set up a new sector specialized to produce press molds; we have trained tool-maker personnel and provided the shop with equipment. Quite a bit has also been done to rebuild them and use them repeatedly.

The economic effectiveness of rebuilding press molds was 45,800 rubles in 1980 alone. In addition to press molds, we are rebuilding inserts and forge stamps, flattening rollers and rims, blocks, draw plates, and so on.

Introduction of a system for setting up technological fittings rebuilding enables us to reduce the demand for new tools, lower their net cost and reduce expenditures of expensive steels, ensuring a savings of 50-60 tons of metal a year.

With Fewer Workers (R. Galbmillion, OTiZ [labor and wages department] deputy chief)

One of the main ways of improving labor resources use is to improve labor rate-setting. When developing and introducing labor norms, we take into account the level of equipment use and degree of physiological stress on the worker. We constantly study the reasons for losses of working time and do time-and-motion studies. As a result, the proportion of technically substantiated output norms at the plant is 93.1 percent for basic production.

Considerable attention is paid to improving workplace organization and servicing, to the use of leading labor procedures and methods, to expanding the zones of multiple machine-tool servicing. More than 1,500 workers have mastered related occupations.

Increasing bearing production with fewer workers is being achieved in significant measure through the brigade form of labor organization. The number of brigades and their composition are determined by production specifics in each structural subdivision. The plant has created 139 multipurpose and 314 specialized brigades in which more than half of all workers are employed.

For example, here is the effect creating brigades in the railroad sector of the blank shop has had. Previously, a significant portion of above-normative rail car idle time was connected to a lack of loaders. Workers such as machinists, weighers, warehousemen and crane operators did not participate in unloading the cars. The plant always had above-normative rail car idle time and paid large fines for it.

After the brigades were organized, the situation changed sharply. Rail car idle time during unloading became the main work indicator for the brigade created here. Workers mastered several specialties each and did all preventive work when there were no cars. As a result, not only was rail car above-normative idle time during unloading eliminated in the blank shop (it was previously about five hours), but they were able to do additional work on transporting metal to the shops. Labor productivity for workers in the railroad sector increased eight percent during the first 10 months of last year.

Continued success without enlisting additional manpower has become a rule of life for our collective.

In a Creative Mood (A. Tsigalov, retainer shop chief)

Multiple-specialty technological operations are characteristic of the retainer shop. The main sources of metal savings are technological improvements in

production and constant updating of the designs of parts being produced. It is through precisely these factors that we obtain about two-thirds of all our metal savings each year.

We work in cooperation with the collectives of the department of the chief technologist, the chief metallurgist and the chief designer. Here are just a few of our joint developments: the technology for casting aluminum-alloy retainers with full use of scrap from our own production (saving up to 25 tons of alloy a year); introduction of technology for the simultaneous cutting of steel retainers of different diameters on a multispindle press, instead of individual cutting (saving up to 15 tons of cast steel a year). With the help of the chief designer's department, we replaced the brass retainers for spherical roller bearings with stamped steel retainers, thus saving more than 200 tons of expensive ferrous metal alloy in 10 months.

A significant place is given to organizational measures. We created a metal saving brigade headed by the assistant head of the production shop, V. Zarovskiy. It also coordinates the activity of shop efficiency specialists. Educational work is also aimed at an intelligent, thrift-minded attitude towards material values.

Competition Helps (N. Khrutskiy, chairman of the plant trade-union committee)

Smith and drill operator M. Tarasenko, initiator of the competition for meeting the assignments of the first year of the 11th Five-Year Plan ahead of schedule, obligated himself to save five tons of comparison fuel, 700 kW-hr of electric power and 10 tons of metal per year. He has met these obligations thanks to his efficient use of forging heat and reducing equipment idle time. Many others have followed his example.

In the automatic lathe shop, leading workers G. Grinevich and M. Bondarev have emerged as pioneers in the movement to save. They met their higher obligations to save metal by reprocessing end scrap and by strictly following technological procedures in turning operations. Now, the entire automatic lathe shop collective is fighting for economy; in particular, it has obligated itself to save 30 tons of ferrous metal and 40,000 kW-hr of electric power in addition to annual obligations previously assumed.

The plant annually holds a contest among creative brigades for the best proposal on saving material resources. Among the best collectives are brigades led by senior foreman A. Krasovskiy and foreman F. Bul'chuk from the universal-joint bearings shop. They had saved 132.5 tons of metal by September, instead of the 110 tons in their annual obligations.

Brigades led by senior foremen N. Zavirakhin and P. Dereshev from the automatic lathe shop also achieved an appreciable metal savings. Given obligations to save 48 tons, N. Zavirakhin's brigade saved 116.5 tons. This success was attained by introducing efficiency proposals aimed at improving the precision of race shearing and reworking end scrap.

A system of monthly analyses of metal expenditure, revealing the reasons for and those guilty of nonproductive losses, by type and section of rolled metal,

is in effect at the enterprise. Under it, planned checks of pattern cutting and the observance of technological discipline are made regularly; output quality and losses due to defects, the causes of defects and underloading of equipment are analyzed weekly, and other questions are also kept in mind. An overall analysis of metal use is made monthly by the plant's chief engineer.

In order to interest everyone in saving metal and using it efficiently, we have introduced a system of moral and material incentives for engineering-technical personnel and workers. Inasmuch as assignments on saving and reducing losses of metal are set shop collectives for the year and the month, we have instituted a special provision under which shop and sector collectives obtain bonuses of 3-8 percent of the cost of the materials saved when established assignments are met. Moreover, the bonus system anticipates the allotting of production subdivisions monetary bonuses of 30-50 percent of the amount obtained by saving all types of energy.

Contribution of Efficiency Specialists (V. Lizogub, chairman of the All-Union Society of Inventors and Efficiency Specialists council)

During the 10th Five-Year Plan, our plant used more than 3,000 innovations with an economic impact of 2.57 million rubles, saved about 800 tons of ferrous and nonferrous metals, saved 5.2 million kilowatt-hours of electric power, and reduced labor expenditures by 1.4 million norm-hours. Production innovators have been working confidently during the 11th Five-Year Plan as well. They have successfully coped with last year's socialist obligations. Seven collectives, including innovators in the universal-joint bearings shop, the consumer goods shop and the chief designer's department, reported fulfillment of their yearly obligations on savings through the use of technical innovations back in August.

Following plant innovator's proposals, we changed, in particular technological processes for obtaining blanks, lowered tolerances and reduced the amount of production scrap. For example, the efficiency proposal by V. Zol'nikov, I. Klyuyko and G. Pogodayev enabled us to obtain rollers from smaller-diameter blanks. The annual economic impact was 6,600 rubles. V. Tolak, V. Sereda and Ye. Amel'yanchik proposed changing the composition of the charge and the smelting technology. The savings was 1,500 rubles. V. Aleksandrov, I. Belousov, F. Kaganovich and A. Noskov proposed that charging holes be "pretapped" automatically instead of cut in retainer bearings production. Labor productivity was increased and the labor-intensiveness of manufacturing needle-bearing retainers was reduced.

The STZ-16 forgings furnaces at our plant are very energy-intensive. Enterprise innovators changed the heating technology and the circuit for switching on the furnaces. A total of 386,700 kW-hr of electric power was saved.

The economic impact of using the technical innovations of inventors and efficiency specialists is not limited to the plant. Thus, introduction of the efficiency proposal by V. Sil'chenko and N. Krepchuk on grinding roller-bearing races by the "intersecting axles" method enables us to improve the geometric parameters of the race, which in turn increases the bearing's durability. Introduction of this technology for just two types of roller bearings will save the country's national economy 78,400 rubles.

The "Young Efficiency Specialist School," the "Principles of Invention and Efficiency Improvement" department at the people's university of technical and economic knowledge and other large-scale organizational measures being carried out by the All-Union Society of Inventors and Efficiency Specialists council and the plant administration are helping increase the creative activeness of innovators.

Plastic Instead of Metal (M. Savastenko, bureau chief in the chief designer's department)

One way of ensuring an increment in production while lowering metal consumption is to use plastics. We began producing bearings with plastic parts comparatively long ago, when mastering production of new types of needle bearings for the Volga and Zaporozh'ye automobile plants. Steel and aluminum alloys had been used for the retainers for these bearings. We began researching the materials needed and the necessary casting procedures, laboratory- and road-tested the new bearings and designed and manufactured the press molds. Time proved that we chose the correct path.

Production of bearings with parts made of polymer materials had increased fourfold in 1980 as compared with 1975, to 2.2 million units. We organized a thermoplastics sector with automatic machines producing about 20 different parts made of synthetic polymer materials. This enabled us to save 627 tons of metal during the five-year plan and to significantly lower labor expenditures.

We are currently series-producing six type-sizes of bearings and are preparing to produce another 13 types. The savings from series-producing the first six is more than 200 tons of ferrous and nonferrous metals per year.

It must be said that, while saving metal by using plastic retainers, we also improved a number of qualitative output indicators. In particular, we improved the precision of bearing rotation, reduced vibration and lowered the labor-intensiveness of their manufacture. For example, transmission bearings with metal retainers in the "Zhiguli" wore out rapidly during operation, so roller bearings fell out. The new bearing with its glass-filler Anid [nylon equivalent] retainer provides a service life of more than 125,000 km, that is, practically eliminating the need to replace it in a transmission. This bearing has been certified in the highest quality category. There are quite a few similar examples.

Personal Participation (L. Nikolayeva)

Brigade leader Ivan Ivanovich Abibik (universal-joint bearing shop) felt the three small blanks in his rough hand and muttered unhappily, "Defective again...."

He moved quickly along the aisle to one of the workers and, after inspecting his machine, began adjusting something.

"It has to be done," he explains. "We are mastering a new method of cold-extruding bearing races. A complicated process. Before we obtain a finished part, we need to perform six operations on an automatic line, and the slightest imprecision in any one of them means we need to begin all over."

It was for good reason that Ivan Abibik's brigade was entrusted with mastering the cold-extrusion method. The brigade leader is a highly-rated specialist who can operate both cold-stamping equipment and surface grinders, as well as stamping brands on races. His love of labor and diligence have been noted by the Order of the Labor Red Banner and other awards. Ivan Ivanovich is a party group organizer and chairman of the shop brigade leaders' council. In a word, one can count on his experience and skill.

Every new undertaking is accompanied by difficulties. And Abibik's brigade has had its share. The first output obtained by cold extrusion was not gratifying. Some 18-20 percent of the races had different wall thicknesses. Adjusting the automatic machine did little. Then it occurred to the brigade leader to change the plunger-die design. At the same time, he suggested a new extrusion die. Tests on the improved stamping tool yielded positive results.

At the same time, testing of a new type of bearing was being completed. And again Ivan Abibik was involved.

"The advantages of cold extrusion over manufacturing bearing races on automatic rod stamps are obvious," says Ivan Ivanovich. "First, we eliminate metal losses in the form of cuttings. The metal use coefficient more than doubles. When changing over to cold extrusion, we save about 30 tons of metal a year just for one type of race, the 904700, which equals a three-month metal rod limit. Second, the time involved in machining the parts is reduced. Whereas machining a certain type of bearing race on a rod stamp might take a minute, the same operation would take only 12 seconds on these automatic lines.

Turning parts on lathes also has a substantial influence on quality. Losses due to defects in this sector alone were reduced by five percent.

The brigade's socialist obligations read: "Save an average of two tons of metal a month." We began seeking out ways to save metal at each workplace. Comprehensive creative brigades were also created to do this. There are two in the universal-joint bearing shop, led by foreman Fedor Bul'chuk and senior foreman Aleksandr Krasovskiy. Last year, they put about 170 tons of metal in the "savings" money-box, given an obligation of 150 tons.

The members of one multipurpose brigade once estimated that the shop incurred significant losses of metal due to improper machine-tool adjustment. It suggested readjustment. To do this, Stanislav Kapustu made special adjustments on the lathe assigned to him. Parts previously scrapped were given new life. That applies to nearly 20,000 to 25,000 bearing races a year. There were special efforts made with those permitting defects. Yaroslav Bronovitskiy, for example, had neglected to adjust his machine properly. The defects continued until discovered in subsequent operations. This case was discussed at a sector meeting and the adjuster promised not to let the collective down any more. And he kept his word. The meeting was a lesson to others as well.

The primary demand now being made on everyone is "learn to save." So multipurpose creative brigade members and all workers are introducing points on saving metal, electric power and auxiliary materials into their socialist obligations for the second year of the five-year plan.

11052
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BENEFITS OF AUTOMATION DISCUSSED

Minsk PROMYSHLENNOST' BELORUSSII in Russian No 4, Apr 82 (signed to press 23 Mar 82) pp 40-42

[Article by M. Zhadovich, Program Preparation Cluster Center at the Minsk branch of the "Orgstankiprom" Institute, project chief engineer V. Suvorov and sector chief M. Moysa: "Centralization, the Main Path"]

[Text] The 18th of April is a red-letter day on our calendar, Soviet Science Day. This has become truly a national holiday, as our future and the well-being of each person are closely linked to the development of our national economy's scientific and technical potential

Implementation of the policy outlined by the 26th CPSU Congress of intensifying the economy in every way possible demands the accelerated utilization and more effective use of the achievements of science and engineering. The key task set by the "Basic Directions of USSR Development in the 11th Five-Year Plan and Up To 1990" is "to ensure continued economic progress in society and profound qualitative advances in the material-technical base on the basis of accelerating scientific-technical progress, intensifying social production and improving its efficiency."

In recent years, a number of measures aimed at perfecting scientific research organization, the network and structure of scientific institutions, and strengthening the ties between science and production have been carried out in our republic. The Academy of Sciences, for example, has put 75,400 m^2 of scientific facilities into operation, including an experimental complex at the Institute of Metalpolymer Systems Mechanics, a building at the Institute of Microbiology and institutes of the Social Sciences Department, facilities at the Nuclear Power Engineering Institute, and others. In order to accelerate the use of scientific developments, extensive use is made of the experimental base of associations and enterprises on the basis of developing progressive forms of ties between science and production. Our republic has 13 scientific-production associations, 32 branch scientific research laboratories in VUZ's, and more than 40 associations of BSSR Academy of Sciences institutes and VUZ's with very large industrial enterprises operating on public principles.

This five-year plan, the republic's scientific forces and its material and financial resources are concentrated on resolving 50 republic programs: seven target comprehensive programs and 43 programs on the most important scientific-

technical and economic problems. Their implementation will help significantly improve labor productivity, save millions of rubles worth of raw and other materials, expand production and improve the quality of consumer goods.

In recent years, numerical preset-control (NPC) equipment ensuring the automation of metalworking in series, small-series and one-of-a-kind production has been introduced intensively in a number of branches of industry. Quickly putting it into operation, keeping it always at full load and in good operating condition have therefore now taken on particular urgency.

Machine-tool building industry in our republic uses NPC machine tools on a broad scale. In this regard, a number of plants produce them as well. At the end of 1980, the NPC machine-tool fleet comprised upwards of seven percent of all metalworking equipment in basic production at its machine-tool building enterprises. During the 10th Five-Year Plan alone, 330 machines were introduced, ensuring the freeing of 223 persons for other work and a total annual economic impact of 328,000 rubles. This five-year plan, we intend to double the fleet of NPC machine tools and to improve its structure. The proportion of multi-operation ("processing-center") machine tools will be increased significantly, for example, and computer-controlled automated sectors and lines, as well as robotized technological complexes, the basic elements in fully-automated production, will also be created.

We should especially stress the fact that republic machine-tool building enterprises as a whole have achieved rather high basic NPC machine-tool operating indicators, including average coefficient values: actual load -- 0.80, shift index -- 1.74, multiple machine-tool servicing -- 1.79. At the same time, certain operating indicators must be improved. In particular, the average time between receipt of a machine and putting it into operation was four months in 1980, which was even a slight increase over the preceding year. One reason is the long cycle of start-up and adjustment, resulting from inefficiency on the part of those doing this work, adjustment organizations and manufacturing plants. Introduction time sometimes increased due to inadequate adjustor skill. The time involved in putting borer and processing-center machines into operation was especially great (sometimes more than a year).

The absence of a single system for setting up NPC equipment start-up and adjustment work not only causes considerable difficulties for user-enterprises, but often also leads to program incompatibility (primarily in coding additional instructions) of machine tools of one model with identical NPC installations. This specific defect in machine tools which are on the whole efficient blocks the interchangeability of control programs, which makes them very inconvenient to operate and makes it extremely difficult to centralize the supplying of enterprises with programs. It should also be noted that the producers of NPC machine tools are also often a source of haphazardousness in coding identical information, primarily for various models of monotypic machine tools.

In order to eliminate these shortcomings, it is appropriate to develop a complex of branch machine-tool building standards which concretize for each NPC machine-tool model the requirements of GOST [All-Union State Standard] 20999-78, "Numerican Preset Control Machine-Tool Installations. Methods of Coding Control Information." The branch standards must also contain common test control programs

which are mandatory both for machine-tool producers and for start-up and adjustment organizations. The programs must be part of the operating documentation supplied with the machine tools.

In view of the long time needed for start-up and adjustment work, and sometimes its insufficiently high quality, a number of qualified user-enterprises are adjusting NPC machine tools of average complexity themselves, although they thus lose their service warranty rights. However, setting up start-up and adjustment work remains a serious problem for users with little experience in operating such machine tools.

NPC machine-tool idle time at machine-tool building plants in Belorussia was reduced two-fold during the 10th Five-Year Plan as compared with the preceding five-year period, to an average of 13 percent of all working time, or 435 hours per machine tool. In view of the significant absolute amount of idle time, as well as the fact that down time for technical reasons comprises about 70 percent of all idle time, one can speak of substantial flaws in the warranty and post-warranty servicing of NPC machine tools. Among the main causes of down time are: large products list of NPC installations in operation, lack of spare parts, poorly-skilled servicing personnel and, in a number of instances, inadequate machine-tool reliability.

About 18 percent of the machine tools at republic machine-tool building plants are now first-generation machines with limited technological possibilities and obsolete NPC installations. Some enterprises have modernized some of their machine tools, improving their efficiency and ease of servicing, either independently or with the help of specialized plants. Such modernization is a significant reserve for increasing NPC equipment productivity. However, it is necessary to develop widely a system of centralized machine tool repair and modernization.

Let us note the positive fact that there has not, in recent years, been substantial NPC machine-tool down time due to a lack of control programs -- the specific technological documentation necessary for the machine tool to perform a prescribed technological operation automatically or semiautomatically -- at republic enterprises. This is to be explained by the fact that efficient, technically equipped, specialized subdivisions have been created at machine-tool building plants; they are NPC machine-tool technological bureaus which prepare programs for their own production facility and do other work associated with the introduction and operation of NPC machine tools.

When replacing production facilities, when there is a heavy influx of new NPC machine tools, and in other instances in which the demand for CP's increases sharply, a number of enterprises use the services of the Program Preparation Cluster Center (PPCC), which performs centralized interbranch servicing at enterprises within its territorial zone (Belorussia and five oblasts of the RSFSR). The extensive use of automated, computerized CP development, processing data for series production and the opportunity of plotting program monitoring provide the cluster center with a significant production potential, given rather high-quality output. In particular, the PPCC developed about 20,000 CP's in the 10th Five-Year Plan, of which 98.8 percent were introduced into production, and it carried out a number of applied studies for enterprises. Extensive work experience by

the PPCC and a number of leading republic enterprises, working together, has shown that an optimum ratio of centralized to decentralized CP preparation reliably ensures the technological preparation of production for NPC machine tools and facilitates the use of progressive data processing and monitoring methods and the broad exchange of leading experience.

NPC machine tools are increasingly being used to work parts in small-series production. This mades increased demands as to flexibility in CP development, which is hard for the cluster center to do, due to its remoteness from clients. One way of providing enterprises with programs under these conditions is to introduce program automation systems adapted to specific user conditions (type of computer, type of NPC equipment being serviced, special requirements). This direction helps specialize the PPCC, which is concerned with software for automated CP preparation and introducing the results both at the PPCC for centralized program preparation and at enterprises it serves in accordance with their technical assignments. The experience of the Automated Line Production Association imeni P. M. Masherov, the Broacher and Shearer Machine-Tool Production Association imeni S. M. Kirov (both in Minsk), the Baranovichskiy Automated Lines Plant, the Gomel'skiy Machine-Tool Plant imeni S. M. Kirov and other enterprises confirms the effectiveness of this direction and the necessity of further developing the automation of program development, particularly using small computers.

Many years of experience in operating the network of program preparation cluster centers in the USSR Ministry of Machine-Tool Building Industry system have shown, on the one hand, a fundamental advantage in the centralized servicing of NPC equipment and, on the other, that its functions are limited today. The fact that organizations doing servicing using other parameters are small and scattered increases the time involved in introducing NPC machine tools and lowers the activeness of their use. It has become necessary to create an interbranch system of centralized NPC equipment servicing for all basic functions.

This important measure is now in the practical implementation stage. The Ministry of Machine-Tool Industry, for example, has created an All-Union Industrial Association for Repairing Metalworking Equipment and Servicing NPC Equipment which includes a group of repair enterprises, as well as a number of specialized organizations, including territorial NPC machine-tool servicing centers (TSC).

The new association is called upon to resolve the following tasks: overhaul and modernization of machine tools, including NPC; production of spare parts for machine tools withdrawn from production, including NPC; start-up and adjustment work and releasing certain NPC machine-tool models for operation; in-warranty machine-tool repair and post-warranty servicing; preparation and introduction of control programs; providing plants with methods assistance in organizing the effective use of NPC machine tools; training and retraining NPC machine-tool operational servicing personnel (jointly with machine-tool manufacturing plants).

Thus, the corresponding TSC will be providing servicing for practically all functions of NPC series-produced machine tools in each territorial zone. The manufacturing plants will service complex or unique equipment, as well as a

number of functions of automated complexes (start-up and adjustment work, in-warranty service, and so forth), the creation of appropriate facilities being anticipated there.

This method of work organization will raise NPC equipment servicing to a qualitatively new level and will permit a significant increase in its effectiveness in the national economy.

11052
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METALWORKING EQUIPMENT

UDC 331.015.1

EQUIPMENT OVERHAULING PLANNING IMPROVEMENT

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 3, 1982 (signed to press 2 Jul 82) pp 10-12

[Article by V.P. Zarzhetskiy, candidate of economic sciences, and A.N. Cherepovskiy, engineer, Voroshilovgrad Machine Building Institute]

[Text] One of the main planning documents regulating the work of the repair service of a machine building enterprise is the annual plan schedule for repairs of equipment. On the basis of the systems used for arranging for repairs, it is appropriate to write this document in two variants--for major overhauls and routine repairs.

For the purpose of introducing a complex of tasks for repair of equipment in an ASUP [automated enterprise management system], an efficient algorithm is necessary for calculating and optimizing the plan schedule on a computer.

An optimization algorithm has been suggested which consists in successively carrying over dates for the repair of machine tools from one month to another until a monthly load close to equal is achieved. It is recommended that the guaranteed underload be assigned to the end of each half-year and that the possibility of carrying over dates for the beginning of the next major overhaul be limited to three months to one side or the other of the preobtained value.

For the purpose of minimizing the amount of equipment whose repair dates have been shifted relative to the precalculated value, the carryover of dates must be performed not according to the list of equipment in the order in which the file has been entered in the computer's memory, but according to the algorithm cited.

Having a predesigned variant of the plan schedule for major overhauls, it is possible to find the total labor intensiveness of major overhaul work over the course of the planned year:

$$T_r = \sum_{i=1}^{m} \sum_{j=1}^{12} T_{ij}, \qquad (1)$$

where T_g is the annual labor intensiveness of major overhaul work in rated output per man-hour, T_{ij} is the labor intensiveness of repairing the i-th machine tool in month j, in rated output per man-hour, and m is the number of units of equipment at the enterprise.

From here it is easy to find the mean monthly load, T_{sr} :

$$T_{sr} = T_g/12 \ . \tag{2}$$

Having calculated the load for each month according to the preliminary variant of the plan schedule, T'_j ,

$$T'_j = \sum_{i=1}^{m} T_{ij}, \tag{3}$$

it is possible to determine the magnitude and sign of deviation from the mean monthly load, $\Delta T'_j$:

$$\Delta T'_j = T'_j - T_{cp}. \tag{4}$$

For the purpose of minimizing the amount of units of equipment whose repair dates are carried over, it is necessary to determine the magnitude and sign of the first month's deviation. If the deviation is greater than the permissible, it is necessary to carry over the repair date. In going to the next month, the unit of equipment is found the labor intensiveness for repairing which is closest to the maximum to the first month's deviation. Here the following relationship must be fulfilled:

$$T_{ij\,\min} = \min(/\Delta\ T'_j - T_{ij}/),\ i = 1,\ 2,\ \ldots,\ m, \tag{5}$$

where $T_{ij\,min}$ is the labor intensiveness of repairing the i-th unit of equipment in month j, whose repair dates are carried over.

If there is an underload in the first month of the year, repair dates are carried over from the next month. Otherwise similar operations are performed with equipment to be repaired in the first month with the carryover of repair dates to the next month of the year. The process is repeated until the first month's deviation becomes below the apriori-established permissible value. Then an analysis is made of deviations of the second month and so on to the end of the year with assignment of the existing underload to the 6th and 12th months by setting the permissible deviation in the direction of overloading in all remaining months of the year.

The indicated permissible amount of deviation of the actual monthly load from the mean monthly is determined by experts. This is inconvenient, since by assigning too low a value for the deviation it is possible to impair the algorithm's ability to function because of the possible origin of a calculation situation in which achievement of the permissible amount of deviation will be impossible. At the

same time irregularity is increased by too high a value for the permissible deviation.

The algorithm described can be modified so that the necessity of predetermination of the amount of permissible deviation disappears. The unit of equipment whose repair date is carried over is determined from equation (5) and after the date is carried over it is calculated by equations (3) and (4).

The plan schedule, optimized according to the algorithm described, for major overhauling of metalworking equipment at the Dnepropetrovsk Combine Plant imeni K.Ye. Voroshilov is shown by curve A in fig 1. Curve B represents the original variant of the plan schedule. Whereas the root-mean-square deviation of actual amounts of repair work from the mean monthly value equals 806.6, in rated output per man-hour, then for the optimized schedule this value equals a total of 53, in rated output per man-hour. The maximum amount of deviation in this case equals 3.1 percent of the mean monthly load.

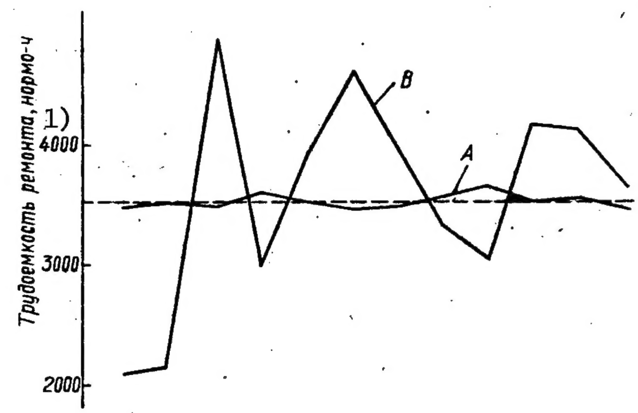

Figure 1. Optimization of Plan Schedule for Major Overhauling of Metalworking Equipment at Dnepropetrovsk Combine Plant imeni K.Ye. Voroshilov

Key:

1. Labor intensiveness of repairs, rated output per man-hour

The algorithm suggested makes it possible to obtain a plan schedule variant which is optimum from the viewpoint of equal loading over months of the year. However, this criterion does not exhaust the requirements which can be imposed on an annual schedule for scheduled preventive maintenance. It is possible, in particular, to assign such optimization criteria as equally sending out for repairs the equipment of various shops of the enterprise, coordinating the plan schedule with predetermined reserved time for carrying out emergency repairs, observance of optimum periods between repairs, coordinating the schedule with the results of analysis of the demand for and existence of spare parts, etc. Consequently, it is necessary to use a multicriterion approach for the purpose of optimizing an annual schedule for scheduled preventive maintenance.

The tools for multicriterion optimization are being improved steadily. However, even at the present time a number of theoretical results can be used for scientific argumentation of decisions made.

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MECHANIZED SECTION FOR MAKING CASTING MOLDS

Kiev TEKHNOLOGIYA I ORGANIZATSIYA PROIZVODSTVA in Russian No 3, 1982 (signed to press 2 Jul 82) pp 20-21

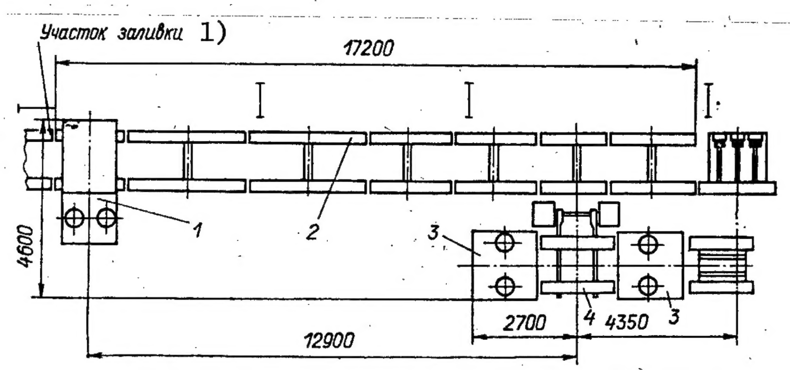
[Article by G.G. Nikkel', engineer]

[Text] The Ivano Franko Special Design Bureau of Automatic Casting Lines (SKB LAL) has developed the model UF22410 mechanized molding section. This section is designed for making molds in foundries with production of a single-unit, small-lot and quantity nature. The section includes a mold assembler, a molding machine, a rotating withdrawing machine, conveying tables, roller conveyers and a control system.

Technical Data

Inside dimensions of molding boxes	1000 X 800 mm
Height of molding boxes	Up to 400 mm
Productivity	45 molds/hour
Method of compaction	Compression with simultaneous shaking, vibrocompression
Unit compaction pressure	Up to 10 kg/cm^2

The configuration and composition of the section's equipment are determined by technological and production requirements, respectively. A section with two molding machines and one rotating withdrawing machine is shown in fig 1.



Key:
1. Casting section

Figure 1. Mechanized Molding Section

The technological process of making molds in the section begins with the delivery by turns of top and bottom boxes which arrive from knock-out along roller conveyers, 2, at a rotating withdrawing machine, 4, where they are assembled with a pattern unit, are turned over and are conveyed to molding machines, 3. Box bottom plates move along the same roller conveyers.

Filling, vibrocompression and delivery to the rotating withdrawing machine, where receiving onto the box bottom plate and withdrawal of half-molds are carried out, are performed at the molding machine. After installation of the cores, the molds are assembled on the assembler, 1, after which they are sent for casting.

After knock-out, empty boxes are delivered to the rotating withdrawing machine, where they are assembled with the pattern unit and half-molds for the top and bottom are made by turns on the molding machine. Then the half-molds are turned and they are withdrawn and are delivered for the installation of cores and assembly of molds.

The model UF22410 molding section has the following advantages over the molding equipment produced on the basis of a model 233M molding machine with a throw-over table: Productivity is increased 1.5- to 2-fold; compaction of molds is performed by multipurpose methods, as well as by noiseless compression with vibration; assembly of a box with a pattern unit, filling of the mixture from the dispenser and cutting off of the mixture's surplus material are made possible; and receiving and releasing of boxes are possible in three directions, which makes it possible to arrange sections in different variants.

A distinctive feature of this molding section is the ability to make molds both in ordinary extruded and in lightweight boxes (molding frames), whose weight is 2- to 3-fold lower than the weight of ordinary ones. This is achieved by the fact that through openings with partitions are made in two or four side walls of the box.

Molds are made on the molding machine by bulk compression on two or four sides through the box's openings and from the top by means of an injection cylinder with simultaneous shaking (vibration). Compression of the mold on all sides improves the quality of compaction and, therefore, of castings, too.

As the result of using a box with openings, the labor intensiveness of making boxes is reduced, the metal savings is considerable (the weight is two to three times lower) and the cost of the box is reduced.

Lightweight boxes can be welded together from thin rolled sheet metal regardless of the unit molding pressure.

The Avtolitmash plant will begin the production of model UF22410 mechanized molding sections in 1984.

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END